**Macao Polytechnic Institute**

**School of Applied Sciences**

**Bachelor of Science in Computing**

**Module Outline**

**Academic Year 2021/2022 Semester 1**

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| **Learning Module** | Performance Evaluation | | | **Class Code** | | COMP315 | |
| **Pre-requisite(s)** | Nil | | | | | | |
| **Medium of**  **Instruction** | English | | | | **Credit** | | 3 |
| **Lecture Hours** | 45 hrs | **Lab/Practice Hours** | 0 hrs | | **Total Hours** | | 45 hrs |
| **Instructor** | Yapeng Wang | | **E-mail** | | yapengwang@ipm.edu.mo | | |
| **Office** | Chi-Un Building A313 | | **Telephone** | | 8599-6432 | | |

**Description**

The aim of this module is to provide students with the main concepts and techniques needed to study the performance of computer systems, plan the capacity of computer systems, predict their future performance under different configurations, and design new applications that meet performance requirements. The module is mainly based on the use of analytic queuing network models of computer systems.

**Learning Outcomes**

After completing the learning module, students will be able to:

1. Apply different metrics and properties for assessing quality of computer systems; (EA2p)

2. Identify the quantitative aspects of the queuing network framework; (EA3p, EA4p)

3. Analyze the results in simple queuing stations systems; (EA3p, EA4p)

4. Formulate equations for single class Mean Value Analysis;(EA3p, EA4p)

5. Identify the important operation and management parts of software development system life cycle;(EP1p)

6. Understand the importance of customer and user needs during software development. (D1p)

**Content**

1. Computer System Lifecycle (3 hours)
   1. QoS in IT Systems
   2. System Life Cycle
2. Descriptive Models (6 hours)
   1. Modeling
   2. Multiple Classes
   3. Open and Closed Classes
   4. Blocking
   5. Software Contention
3. Basic Performance Laws (6 hours)
   1. Utilization Law
   2. Service Demand Law
   3. The Forced Flow Law
   4. Little's Law
   5. Interactive Response Time Law
   6. Bounds on Performance
4. Performance Engineering Methodology (6 hours)
   1. A Model-based Methodologies
   2. Workload Model
   3. Performance Model
   4. Specifying Performance Objectives
5. Evaluating Database Service (6 hours)
   1. Database Service Example
   2. Building a Performance Model
   3. Measurements Techniques
   4. Obtaining Input Parameters
6. Markov Models (6 hours)
   1. Model Construction
   2. Model Solution and Interpretation
   3. Model Assumptions and Limitations
   4. Generalized Birth-Death Models
7. Single Queue Systems (6 hours)
   1. The G/G/1 Queue
   2. The M/M/1 Queue
   3. The M/G/1 Queue
   4. M/G/1 with Vacations
8. Single Class MVA (6 hours)
   1. MVA Development
   2. The MVA Algorithm
   3. Balanced Systems

**Teaching Method**

Lectures, tutorials and group discussion, etc.

**Attendance**

Attendance requirements are governed by the “Academic Regulations Governing Bachelor’s Degree Programmes of Macao Polytechnic Institute”. Students who do not meet the attendance requirements for the course will not be permitted to sit the final and re-sit examination and shall be awarded an ‘F’ grade.

**Assessment**

This learning module is graded on a 100 point scale, with 100 being the highest possible score and 50 being the passing score.

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|  | **Item** |  | **Description** | **LO** |  | | **Percentage** | |
| 1. | Assignments |  | Home-based exercises | EA2p, EA3p, EA4p, D1p |  | | 30% | |
| 2. | Test |  | Knowledge assessment | EA3p,EA4p, EP1p, D1p |  | | 20% | |
| 3. | Examination |  | 3-hour written examination | EA3p, EA4p, EP1p, D1p |  | | 50% | |
|  |  | | **Total Percentage:** | | | 100% | |

Students with an overall score of less than 35 in the coursework must take the re-sit examination even if the overall score for the course is 50 or above.

Students with a score of less than 35 in the final examination must take the re-sit examination even if the overall score for the course is 50 or above.

Students with an overall final grade of less than 35 are NOT allowed to take the re-sit examination.

**Teaching Material**

**Textbook(s)**

No textbook. Notes will be provided.

**Reference**

**Reference book(s)**

1. Menasce, D.A., Dowdy L.W., & Almeida, V.A.F. (2004), *Performance by Design: Computer Capacity Planning By Example*. Prentice Hall PTR.
2. Menasce, D.A., & Almeida, V.A.F. (2001), *Capacity Planning for Web Services: Metrics, Models, and Methods*. Prentice Hall PTR.
3. Gunter Bolch, Stefan Greiner, et al. (2006),Queueing Networks and Markov Chains. Wiley-Interscience.
4. Boudec, J.L. (2014), Performance evaluation of computer and communication systems.EPFL Press.
5. Bolch Greiner de Meer Trivedi. (2006), Queueing Networks and Markov Chains. Wiley.